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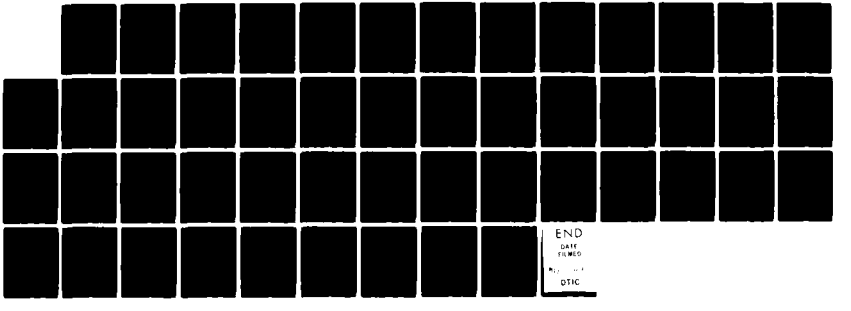

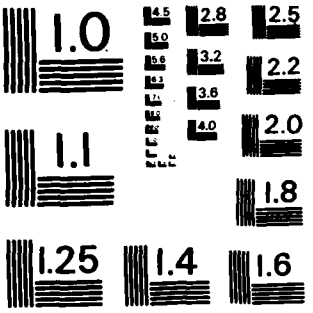

REVIEW OF RESEARCH ON TEACHERS' PEDAGOGICAL JUDGMENTS, PLANS, AND DECISIONS

Richard J. Shavelson

November 1982

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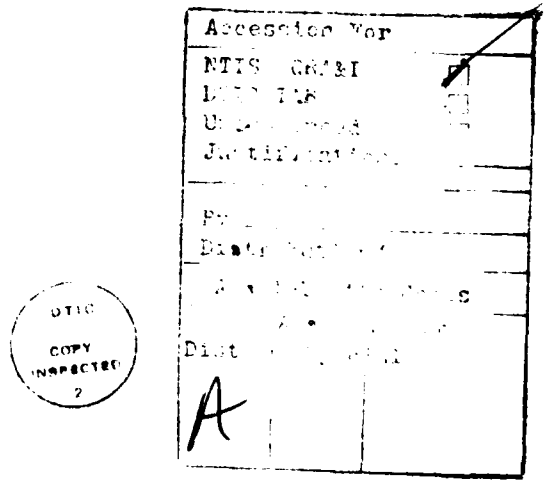

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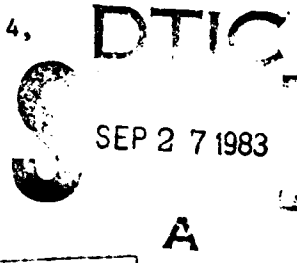

INTRODUCTION

In this paper, research on teacher's judgments and instructional planning and their decision making during classroom interaction is reviewed. The need for research on teaching to examine not only teachers' behavior but also their judgments, plans, and decisions and the relationship of these to behavior is justified on several grounds. First, a solely behavioral model is conceptually incomplete because it cannot account for predictable behavioral variations among teachers arising from differences in their goals, judgments, and decisions. A second justification is that research linking teachers' intentions to their behavior will provide a sound basis for educating teachers and implementing educational innovations.

Assumptions of research

This research rests on two fundamental assumptions. First, teachers are rational professionals, who, like other professionals such as physicians, make judgments and carry out decisions in an uncertain, complex environment (e.g., Shavelson 1973, 1976; National Institute of Education 1975; Shulman & Elstein 1975; Clark 1978-79; Shavelson & Stern 1981). For at least two reasons this assumption of rationality actually refers to teachers' intentions for their judgments and decisions rather than to their behavior. The first and most obvious reason is that some teaching situations call for immediate responses that probably preclude rational processing of information in making informed judgments or decisions. The second reason is that a person's capacity for

formulating and solving complex problems such as those presented in teaching is very small compared with the enormous capacity of some "ideal" model of rationality. A person constructs a simplified model of a real situation in order to reduce its complexity. Thus, teachers behave rationally with respect to the simplified models of reality that they construct. The conception of teachers as rational within the constraints of their information processing capabilities leads to a modification of the first assumption: Teachers behave reasonably in making judgments and decisions.

The second assumption on which research reviewed here is based is that teachers' behavior is guided by their thoughts, judgments, and decisions.

Methods of studying teachers' mental processes

Research on teachers' judgments and decisions has a characteristic set of methods somewhat different from previous correlational and experimental research. These include policy capturing, lens modeling, process tracing, stimulated recall, case study, and ethnography (for discussions of one or more of these methods, see Shulman & Elstein [1975]; Einhorn, Kleinmuntz & Kleinmuntz [1979]; Erickson [1979a, 1979b]; Ericsson & Simon [1980].

Policy capturing and lens modeling. In a hypothetical policy-capturing study, teachers might be given descriptions of 32 hypothetical students, and researchers would systematically vary five variables in these descriptions, such as student achievement, gender, class participation, ability to work independently, and classroom behavior. Each teacher would judge each student's chance of earning a B average or better at the end of the school year. Teachers' judgments would then be

predicted from the five variables describing the student. The prediction equation would be interpreted as a model of the teacher's policy for judging students' probable success. Policy capturing models are quite simple. Simple additive models, which seldom have more than three variables, often predict judgments quite well, even though the models may represent fairly complex judgmental strategies (Einhorn et al. 1979).

There are, however, several limitations in the application of this approach. First, typical policy-capturing studies are carried out in a laboratory with hypothetical judgmental tasks, although this need not be the case. Hence, a question of generalizability arises. Second, prediction equations usually combine data from all of the teachers in a study. However, this procedure is based on the assumption that each teacher has exactly the same policy. Cadwell (1980) has shown both theoretically and empirically that this usually is not the case; subsets of teachers may share the same policy, or each teacher may have a unique policy. And third, great care must be taken in interpreting the results of a policy-capturing study. The prediction equation provides an "as if" model; it does not mean that teachers actually reach a judgment by taking a weighted sum of the variables.

In a lens-modeling study, three types of information are required: (a) a criterion measure of the event being judged (e.g., students' preferences for reading materials), (b) a list of cues predictive of the criterion measure (e.g., presence or absence of fantasy, animals, danger, and humor), and (c) teachers' judgments of students' preferences (i.e., predictions of each student's reading preference). The correlation between a teacher's predictions of students' reading

preferences and students' actual preferences provides a measure of overall judgmental accuracy. A regression of a teacher's judgments on the cues provides a model of the teachers' policies for reaching their judgments. The limitations of this approach are similar to those of policy capturing.

Process tracing and stimulated recall. In a process tracing study, subjects are asked to "think aloud" while performing a task, solving a problem, or reaching a decision. For example, Peterson, Marx, and Clark (1978) asked teachers to think aloud while they planned a social studies lesson. The verbal protocol becomes the data to be analyzed. The analysis may be content analysis (e.g., the number of references to behavioral objectives is counted) or a flow chart modeling the teacher's thought processes (e.g., Fig. 2).

Typically, stimulated recall is used when process tracing interferes with task performance. With this method, a teacher's lesson is either audio- or videotaped and later played back to the teacher, who attempts to recall the covert mental activities that accompanied the overt behavior.

Both techniques use verbal reports as indicators of the cognitive processes of teachers. They assume that teachers are able and willing to articulate their thought processes. This assumption of introspection has a long and controversial history (cf. Nisbett & Wilson 1977; Ericsson & Simon 1980). Ericsson and Simon (1980) provide an analysis of when introspective data are accurate and when they are not. They conclude,

> "It is time to abandon the careless charge of introspection as a means for disparaging such data. They describe human behavior that

> is as readily interpreted as any other human behavior. To omit them when we are carrying the chain and transit of objective measurement is only to mark as terra incognita large areas on the map of human cognition that we know perfectly well how to survey" (p. 247).

Case study and ethnography. A case study is a narrative account of an object of social inquiry such as a classroom, a school system, or any other bounded system (cf. Stake 1978) in its cultural context and is usually more descriptive than theoretical. The more psychologically and cognitively oriented ethnographers assume that "individuals have meaning structures that determine much of their behavior. . .[and] that they seek to discover what these meaning structures are, how they develop, and how they influence behavior, in as comprehensive and objective a fashion as possible" (Wilson 1977, p. 254). Qualitative research, then, "is predicated upon the assumption that an 'inner understanding' enables the comprehension of human behavior in greater depth than is possible from the study of surface behavior, from paper and pencil tests and from standardized interviews" (Rist 1979, p. 20).

The assumptions of qualitative research are quite consistent with a major premise of research on teachers' decision making: In order to understand teaching, one must understand teachers' goals, judgments, and decisions, especially in relation to teacher behavior and classroom context. The potential contribution of qualitative research to research on teaching is that fieldwork methods (e.g., participant observation, focused interviewing) and analytic techniques (e.g., development of conceptual and categorical systems from data) developed by qualitative researchers have their canons of methodological rigor just as

quantitative methods do (e.g., Filstead 1970; Wilson 1977; Erickson 1979a, 1979b).

The fact that qualitative methods have their own procedural standards is often blurred by the misuse of these methods (Rist 1979). Erickson (1979b) pointed out a number of limitations and potential problems with ethnographies, some of which arise when the methodological canons become blurred: (a) timing--by the time the ethnology is written, it is too late for use; (b) validity--ethnographers may not have been intensive enough or may have been inept, or the informants may not have been articulate or may have concealed information; (c) superficiality--description may have stopped at surface appearances; (d) evidentiary adequacy--the level of inference about overall trends may not be supported by the data.

Methodological adequacy of the studies reviewed

The studies examined in this review have used a wide variety of research methods. The adequacy of the procedures used in some types of studies (e.g., experiments with standard psychometric instruments) is easier to evaluate than in other types of studies (e.g., short reports of ethnographies, stimulated recall data). Researchers studying teachers' thoughts, judgments, and decisions often do not provide adequate descriptions of their methods; incorporate methodological checks in their studies; or systematically study methods used in this field of research. Given these limitations, it was virtually impossible to evaluate critically some of the individual studies examined in this review. In these cases, replicability was used as a criterion for including a study. That is, individual studies that could not be evaluated adequately on methodological grounds, yet produced consistent results, were included.

TEACHERS' JUDGMENTS

Judgment refers to the process of evaluating or categorizing a person or an object. Often the process of judgment is called classification, selection, or estimation. This process is not simply the application of a rule; judgment goes beyond the available information, adding information as the process progresses (cf. Shulman & Elstein 1975).

Teachers classify students along many dimensions. Teachers' classification of students according to ability can be seen in the membership of different reading groups, teams, and so on. Teachers select students for referrals to special education, for tasks such as taking attendance, reading an essay, and the like. And teachers estimate students' abilities, class participation, independence, self-concepts and so on. Judgment thus permeates teaching. It is an important process that until recently has been given little systematic attention by researchers on teaching and even less attention by teacher trainers.

Conceptualizations of teachers' judgments

One of the first attempts to conceptualize the judgmental processes used by teachers was reported by Varner in 1923. Varner actually was studying the accuracy of teachers' ratings of students' intelligence, because in the absence of measurements of traits other than intelligence, teachers' ratings of these traits would have to be used. In the case of intelligence, a criterion--the IQ test--existed. Teachers' rating of students' intelligence could be compared with this

criterion. From this comparison, Varner reasoned, a generalization could be drawn about the accuracy of teachers' ratings of other traits.

Varner (1922, 1923) assumed that teachers' estimates, or judgments, of students' intelligence were inaccurate. He identified five factors that contributed to this inaccuracy and thus developed a concept of the judgmental process similar to present-day theories.

One factor influencing teachers' judgments was that teachers tended to be influenced by traits other than intelligence in rating intelligence (e.g., industry, personality, appearance). This factor, then, is akin to a halo effect in the judgmental process.

A second factor was that some teachers failed to take students' ages into account when rating their intelligence. Varner presented evidence that, as expected, teacher ratings correlated higher with an intelligence quotient than with mental-age scores. In other words, teachers failed to consider available information that could increase the accuracy of their ratings.

Third, the accuracy of teachers' ratings was lower for younger children than for older children. For example, Varner (1922) found that teachers' classifications of children into the highest twentieth and lowest twentieth percentiles more closely approximated a classification based on intelligence test scores for eighth grade students (42% correctly classified in the highest group; 63% correctly classified in the lowest group) than for second grade students (22% and 53%, respectively). This finding is consistent with current psychometric data; measurements on very young children are less reliable than measurements on older children, in part because of differences in rates of intellectual, emotional, and experiential growth.

A fourth factor was the inability of teachers to compare their pupils with pupils in general of corresponding grade levels. Put in more modern terms, teachers' relative judgments (ordering of students within their classes) were more accurate than their absolute judgments of their students' IQ scores. This finding is consistent with psychometric theory and empirical findings that errors of measurement associated with absolute judgments are greater than or equal to errors associated with relative judgments (e.g., Shavelson & Webb 1981).

The fifth factor was the teachers' tendency to rate students too high. Teachers tended not to want to rate children too low. This is consistent with recent findings of leniency in grading, for example.

Varner (1923) conducted a series of studies that provided a test of this concept of teacher judgment. He constructed detailed instructions and a rating form which addressed each factor. He demonstrated, under a variety of conditions, that teachers' ratings using his rating instrument were more accurate than ratings made without it. For example, in one study, correlations of teachers' ratings of IQ without the instrument with IQ test scores ranged from .31 to .71 with a median of .58, while IQ ratings with the instrument ranged from .63 to .70 with a median of .64. Correlations with mental-age scores of ratings of mental age without the instrument ranged from .23 to .66 (median = .42) while with the instrument the correlations ranged from .39 to .81 (median = .64).

About 50 years later, Shavelson (1973, 1976; see also Shulman & Elstein 1975) developed a model of teachers' judgments and pedagogical decisions as a heuristic for organizing and conducting research on

teaching. The model suggested a set of questions and conjectures about what information teachers use in making pedagogical judgments, how this information is integrated to reach judgments, and how institutional constraints and individual differences among teachers affect these judgments (see fig. 1).

The model assumes that teaching is a process by which teachers make reasonable judgments and decisions with the intent of optimizing student outcomes (Shavelson 1976). While teachers' judgments and decision making do not always match this description, the model seems to apply to many goal-oriented teaching situations. For example, in recalling their thoughts while viewing a videotape of their teaching, "Teachers were most affected by their concern for the pupil and based many of their decisions on what they surmised was happening with the individual student. . . . Content accounted for the bulk of the remaining concerns voiced. Teachers apparently focused much of their attention on what was occurring during the lesson, i.e., what the students were hearing, saying, doing, and feeling" (McNair 1978-79, p. 32).

Teachers are seen as active agents with many instructional techniques at their disposal to help students reach some goal. In order to choose from this repertoire, teachers must integrate a large amount of information about students from a variety of sources. Teachers must somehow relate this information to their own beliefs and goals, the nature of the instructional task, the constraints of the situation, and so on, in order to reach a judgment (for details, see Shavelson & Stern 1981).

The model (fig. 1) identifies some important factors that may affect teachers' judgments. Teachers have available a large amount of

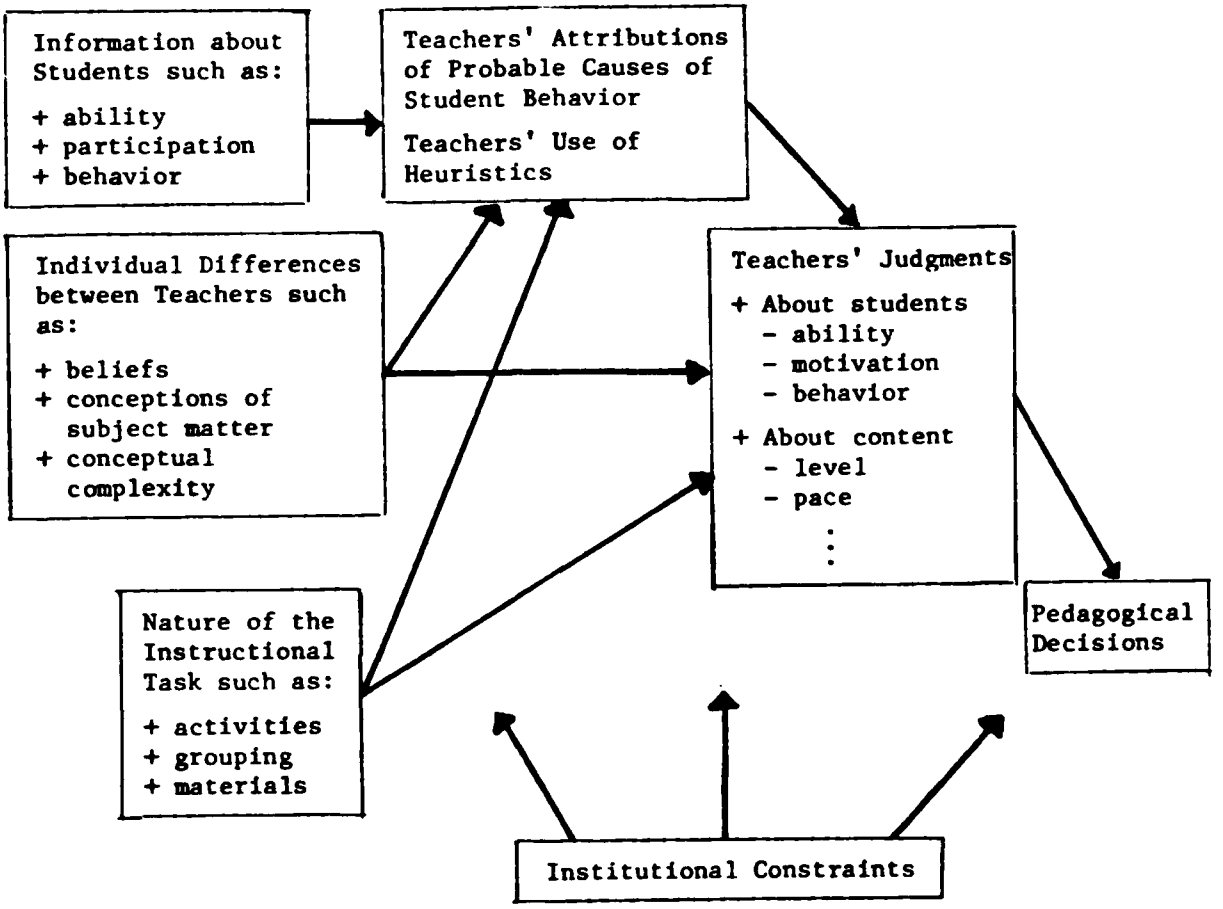

Fig. 1. Some factors contributing to teachers' pedagogical judgments and decisions (from Shavelson & Stern, 1981, p. 472).

information about their students. Teachers usually seek information about their students' general abilities or achievement, class participation, self-concepts, social competence, independence, classroom behavior, and work habits (Shavelson & Stern 1981). This information comes from many sources, such as their own informal observations, anecdotal reports of other teachers, standardized test scores, and school records. In order to use a large amount of information, teachers integrate it to form judgments about students' cognitive, affective, and behavioral states. These judgments, if relevant, are used in making pedagogical decisions (e.g., Shavelson 1976).

Attributions and heuristics (fig. 1) posit that information is selected and integrated by teachers to reach a judgment, in part on the basis of a few heuristics and their attributions for the causes of events. Teachers' attributions for the causes of achievement may serve as the basis for teachers' judgments about students, such as student ability, effort, and classroom behavior (cf. Borko & Shavelson 1978). Thus, the literature on attribution theory in general and achievement attribution in particular is pertinent; it has been reviewed by Weiner (1977) and Kelley and Michela (1980) (see also Borko & Shavelson 1978; Nisbett & Ross 1980); therefore, it will not be reviewed here.

Because people are unable to process simultaneously a large amount of information, they use heuristics for selecting information (salience and vividness heuristic), judging the frequency or probability of an event (availability), classifying persons and objects (representativeness), and revising their initial judgments (adjustment and anchoring). While these heuristics lead to accurate judgments in

many situations, they may also lead to predictable errors (Tversky & Kahneman 1974; Nisbett & Ross 1980).

The representativeness heuristic states that people decide whether or not some person or object belongs to a particular category by judging the similarity between the attributes of the person or object and the attributes of the category (Tversky & Kahneman 1974). For example, when a description of a student matches the stereotype of a slow learner, even if the description is unreliable, incomplete, or outdated, people often predict with high certainty that the student is a slow learner. Dusek (1975) and Smith and Ligenbuhl (1976) have shown in laboratory studies that teacher-student interaction is influenced by unreliable information about the student.

The anchoring heuristic states, "People make estimates about events and other people by starting from an initial value that is adjusted to yield a final answer. The initial value, or starting point, may be suggested by the formulation of the problem, or it may be the result of a partial computation. In either case, adjustments are typically insufficient. That is, different starting points yield different estimates, which are biased toward the initial values" (Tversky & Kahneman 1974, p. 1128). For example, subjects were asked to estimate the percentage of African countries in the United Nations. They were given an initial percentage determined at random and asked to estimate the actual percentage. Groups of subjects beginning at either 10% or 65% estimated actual percentages of 25% and 45%, respectively. Shavelson, Atwood, and Borko (1977) suggested that this heuristic might be one mechanism underlying the teacher expectancy phenomenon in that a teacher's initial expectation may serve as an anchor for his or her

subsequent estimate of a student's ability. In a number of studies reviewed by Dusek (1975), initial but not necessarily valid information about students influenced ("anchored") the way tutors taught students. Brophy and Good (1970) found that teachers' estimates of student ability influenced teacher-student interaction.

In a laboratory simulation, Shavelson, Cadwell and Izu (1977) examined subjects' estimates of a student's ability based on either reliable or unreliable information and their willingness to revise these estimates on the basis of subsequent information, which was either reliable or unreliable. They reported that, "The subjects did consider the reliability of the information, adjusting their estimates in the direction predicted by. . .[a normative] Bayesian model. Furthermore, the anchoring heuristic and research on teacher expectancy suggest that initial estimates are difficult to overcome, even in the face of conflicting information. Nevertheless, the data show that the subjects did revise initial probability estimates, as expected by Bayes' Theorem" (p. 95).

These findings contradict much of the judgment literature on the use of heuristics (e.g., Einhorn & Hogarth 1978; Slovic, Fischoff, & Lichtenstein 1976). There are a number of possible explanations. One is that most studies have used undergraduate students making judgments in areas outside their expertise. The teachers and students in a graduate school of education who were subjects in the Shavelson, Cadwell and Izu (1977) study may not fall prey to these errors (Winkler and Murphy 1973; but see Slovic et al. 1976). A second possible explanation is that the laboratory simulation was so highly structured that the subjects could only act rationally. Further research is needed to explain these findings.

Attributions refer to the processes by which people integrate information to arrive at causal explanations for events (Borko & Shavelson 1978). To make attributions, the perceiver (e.g., the teacher) is assumed to know the generality of an actor's (e.g., thre student's) behavior across contexts (consistency information), across entities (distinctiveness information), and the generality of the reaction across other actors (consensus information). Various patterns of this information give rise to different attributions. Attributions to the actor (student) arise when there is high consistency (Sally always passes this particular math test), low distinctiveness (Sally passes most other math tests), and low consensus (hardly any other student passes this particular math test). Under these conditions, teachers would perceive Sally as a good math student. Attributions to the test (stimulus attribution) occur when Sally always passes this test (low distinctiveness) and everyone else passes the test (high consensus). A perceiver who has limited information will try to find the most consistent pattern with the information available.

Finally, conflict stress refers to psychoemotional processes. These processes may affect the choice of information teachers use to construct their psychological realities (cf. Janis & Mann 1977), even though past research in this area has not focused on teachers.

By generalization, heuristics, attributions, and conflict stress might be expected to influence teachers' judgments about students, instructional activities, and institutional constraints. Depending on the focus of the research, these judgments may take the form of expectations, hypotheses, or inferences.

Research modeling teachers' judgments

Much of the research on teachers' judgments and decision making has used a policy capturing approach. With this approach, for example, teachers make judgments about a number of students based on their observations of the students in their classrooms or on information provided by the researcher. Then teachers' judgments are predicted on the basis of information available to teachers (e.g., achievement, work habits, classroom participation, classroom behavior). The result is a statistical model that weights each piece of information in order to maximize prediction of the teacher's actual judgments.

Research on human judgment has found that people's policies can be represented by an additive model that contains three pieces of information. Research on teachers' policies for judging ability, motivation, and the probability that a student will be a behavior problem generally supports these findings. Laboratory simulations have found that, in judging student ability, teachers primarily use information about student achievement, but they may also use information about problematic behavior (see Shavelson & Stern [1981] for references). In judging motivation (effort), teachers rely heavily on information about achievement, problematic behavior, and work habits. Estimates of behavior problems rely on information about classroom behavior and, to a lesser extent, achievement.

Research on human judgments has found that people are generally unaware of the nature of their judgment policies. Hence, they report using more information in more complex ways than is suggested by the statistical model of their policies (e.g., Shulman & Elstein 1975;

Slovic et al. 1976). Studies of teachers' policies have produced similar findings. For example, Clark and Yinger (1979) reported that teachers were unaware of their judgment policies.

Accuracy of teachers' judgments of students' intelligence. Research on the accuracy of teachers' judgments of their students' intelligence typically has correlated intelligence-test scores with teachers' ratings or rankings of their students. This research shows that teachers are, in general, reasonably accurate in spite of what critics might assert. Based on eight studies reported before 1930, the median correlation was .54, with a range from .31 to .70. Based on six studies reported since 1930, the median correlation was .54, with a range from .42 to .81.

How high should this correlation be? Critics might consider a correlation of .54 between teachers' judgments and intelligence-test scores too low. In contrast, some researchers consider this degree of accuracy credible. In making your own decision, consider the following. First, most "strong" validity coefficients (correlations between predictors such as teachers' judgments and criterion scores such as intelligence-test scores) are .50 in magnitude. It is unusual for validity coefficients to rise above .60. Second, teachers' implicit definitions of intelligence do not correspond to the definition that guides intelligence-test construction, something Varner recognized in 1923. Hence, teachers' ratings are not based on the trait measured by intelligence tests. This will tend to reduce the correlations.

Coverage of this topic would be incomplete without noting the large variability among teachers in the accuracy of judgments of their students' intelligence. Accuracy, as measured by correlations,

generally ranges from lows in the .20s to highs in the .80s. Few studies have examined what accounts for this variability; Varner's (1923) is a notable exception.

Accuracy of teachers' judgments of students' achievement. Research on this topic typically has correlated teachers' ratings or grades assigned to students with achievement-test scores. Studies indicate that teachers are reasonably accurate in making this judgment (see Shavelson & Stern 1981). The median correlation based on over fifteen studies was .71, with a range from .33 to .96.

Judgments and diagnoses regarding reading. Byers and Evans (1980) studied the accuracy of teachers' judgments of students' reading interests. Teachers judged their students' reading preferences; students' actual reading choices served as the criterion measure. Byers and Evans found that students' reading interests fluctuated widely according to grade level and gender and that most teachers inaccurately predicted students' reading preferences (overall range of accuracy was -.23 to .69, with a mean of .23), because they lacked knowledge about students' interests.

Teachers' and expert clinicians' diagnoses of childrens' reading problems have been studied extensively by Vinsonhaler and his colleagues (e.g., Vinsonhaler 1979; Gil 1980; Weinshank 1980). They have conducted three types of studies: (1) laboratory and classroom studies of reading specialists, special education personnel, and classroom teachers diagnosing children's reading problems; (2) computer simulation studies; and (3) training studies.

Four laboratory and classroom studies have examined the degree to which reading clinicians and classroom teachers agree on the diagnosis

of reading problems (Vinsonhaler 1979; Gil 1980; Weinshank 1980). The agreement corollary of their inquiry theory states that (a) individuals' diagnoses are more closely related to the "average diagnosis" based on a group of clinicians ("group agreement") than are diagnoses among individuals, and (b) agreement between diagnoses made by one individual on equivalent cases ("intraclinician agreement") should be greater than agreement between clinicians ("interclinician agreement").

The results of the studies indicated that there was reasonable group agreement on diagnosis (e.g., agreement measure of .55 in Vinsonhaler [1979]; and .45 in Gil [1980]. However, the intraclinician agreement coefficients (e g., .17 in Vinsonhaler [1979]; and .14 in Weinshank [1980] and the interclinician agreement coefficients (e.g., -.07 in Vinsonhaler [1979]; -.04 in Gil [1980]; and .11 in Weinshank [1980] were very low. Reading clinicians, special educators, and classroom teachers did not agree with themselves and with each other on diagnosis. Neither did they agree on remediation (interclinician agreement = .10, intraclinician agreement = -.20; Weinshank 1980). In addition, a correlation of zero was found between diagnosis and remediation at the individual level (Weinshank 1980).

Gil (1980) observed and interviewed teachers about their diagnoses. He found that the 10 teachers lacked systematic strategies for collecting and using information to reach diagnostic decisions; they differed on a number of process variables, such as the length of their involvement with a case and the number of cues collected; and they used general and incomplete diagnostic strategies, both in the laboratory and in the natural classroom setting. Teachers appeared to lack the information processing strategies needed to make complete, specific

diagnoses. In addition, Weinshank (1980) found that individual clinicians involved with a case tended not to follow their stated plans of action regarding data collection procedures, diagnosis, and remediation.

Computer simulation studies examined diagnostic accuracy as a function of having a specific routine for collecting information on a case and generating a few or many hypotheses, depending on the certainty of the hypotheses. These studies found that simulations that used routine cue collection procedures and generated hypotheses early performed significantly better than those that did not. However, the simulations did not perform as well as the human clinicians who diagnosed the same cases. Finally, training teachers to conduct a systematic diagnosis of a reading problem increased the accuracy of their diagnoses. Nevertheless, the accuracy for most trainees was below that considered appropriate.

Teachers' judgments are a critical component of the teaching process. Their judgments of general ability traits--intelligence and achievement--are reasonably accurate. However, the accuracy of their judgments of students' behavior on particular tasks--or of students' reading problems--is considerably lower than would be hoped for. While there is some evidence that training can overcome these inaccuracies to some degree, additional research on teachers' judgmental processes is needed. Such research would serve as the basis for training teachers to improve their judgments and thus their effectiveness in helping students reach valued educational goals.

TEACHERS' PLANNING

When teachers plan, they formulate a course of action for carrying out instruction over a school year, a semester, a month, a day, or a lesson. Planning is one important component of teaching that is typically carried out without the presence of students.

The importance of planning cannot be overestimated. Decisions made during planning have a profound influence on teachers' classroom behavior and on the nature and outcomes of the education children receive. Teachers' instructional plans serve as "scripts" for carrying out interactive teaching (Shavelson & Stern 1981; see also Smith & Sendelbach 1979). Plans exert such a strong influence on teachers that teachers tend not to deviate from them once they have begun teaching (Zahorik 1970; Peterson & Clark 1978; Joyce 1978-79; Shavelson & Stern 1981. By knowing a teacher's plan for a particular lesson, much of the teacher's behavior in the classroom can be predicted. Stern and Shavelson (1981) found this to be true of reading instruction, and Smith and Sendelbach (1979) found this to be true of science instruction; both used ethnographic studies of single classrooms.

Teachers' planning decisions influence the content, materials, social climate, and activities of instruction. For example, decisions about curriculum adoptions, or at least selections from and modifications of adopted curricula, affect the process of teaching (Smith & Sendelbach 1979) as well as what children learn (Walker & Schaffarzick 1974). Also, decisions about grouping students for reading have been shown to have such a profound effect that children in the highest reading group may cover 13 times as many new vocabulary words as

children in the lowest reading group, with reading test scores reflecting this difference in pacing (Shavelson & Borko 1979).

Instructional plans

Most teachers are trained to plan instruction by specifying behavioral objectives, specifying students' entering knowledge and skills, selecting and sequencing learning activities so that students accomplish objectives, and evaluating the outcomes of instruction in order to improve planning. While this prescriptive model of planning may be one of the most common features of the curricula of teacher education programs, the model is not consistently used by teachers in planning instruction. Obviously there is a mismatch between the model and the demands of classroom instruction. This mismatch arises because teachers must balance multiple educational goals (e.g., content instruction, behavior control, social interaction), take into account students' goals (peer relations, learning), and maintain the "flow of activity" during a lesson or face behavioral management problems (Doyle 1979, 1980). Activities, then, not the prescriptive model, are the focus of teacher planning.

As Taylor (1970) pointed out, most planning appears unsystematic and general in nature. Teachers are uncertain as to what the planning process requires. To date, research on teacher planning has not led to the formulation of a model of planning; rather, it has identified components that such a model must incorporate to be descriptive and to be realistically prescriptive.

The instructional activity is the basic instructional unit of planning (Zahorik 1975; Yinger 1977; Peterson et al. 1978; Clark &

Yinger 1979; Smith & Sendelbach 1979) and action in the classroom (Shavelson & Stern 1981). We term the basic, structural unit of planning the "task." A task contains several elements that have individually been identified in the planning literature. One element is content, the subject matter to be taught (e.g., Clark & Yinger 1979). Once a curriculum has been selected, teachers accept the text as the major, and usually only, source of content (e.g., Shavelson 1976; Smith & Sendelbach 1979). A second element of a task is materials, those things that children can observe and/or manipulate (e.g., Morine-Dershimer 1978-79b; Peterson & Clark 1978; Zahorik 1975). A third element of a task is activity, what the teacher and students will be doing during the lesson (e.g., Clark & Yinger 1979; Smith & Sendelbach 1979). The concept of activity includes sequencing, pacing, and timing the instructional content and materials (cf. Taylor 1970; Smith & Sendelbach 1979). A fourth element is goals, the teacher's general aim for a task, usually learning, effect, or both. Goals are not the same as behavioral objectives; they are much more general and vague, but they are functional (cf. Clark & Yinger 1979). A fifth element is students, especially their abilities, needs, and interests (Shavelson, Atwood, & Borko 1977; Morine-Dershimer 1978-79b; Borko, Cone, Russo, & Shavelson 1979). The last element is social-cultural context of instruction (cf. Janesick 1978; Florio 1979; Shavelson & Borko 1979). This refers to the class as a whole and its sense of "groupness" (Janesick 1978), a specially created community (Florio 1979), as well as teachers' groupings of students for instruction (e.g., tutor-tutee, reading groups; cf. Barr 1974, 1975; Borko 1978; Shavelson & Borko 1979).

The conception of teachers' planning presented here is one in which instructional tasks are created by the teacher. We know that, in creating tasks, teachers differentially emphasize some or all of the elements described above. In addition, any conception of planning must include a time dimension. One aspect of the time dimension is the hierarchical organization of planning; Yinger (1977, p. 172) identified five levels: (1) yearly planning for academic subjects, (2) term planning for academic subjects and certain materials, (3) monthly planning for basic academic units and necessary materials, (4) weekly planning for specific units and time allocation, and (5) daily planning.

A second aspect of the time dimension is that planning decisions made early in the academic year exert a profound influence on teachers' planning for the remainder of the year (e.g., Clark 1978-79; Joyce 1978-79). According to Joyce (1978-79, p. 75): "Most of the important preactive decisions by teachers are long-term in their influence as opposed to the influence of lesson by lesson planning. Relatively early in the year, most teachers set up a series of conditions which were to be powerfully influential on the possibilities of decision making thereafter. Lesson planning, to the extent that it goes on consciously, involves the selection and handling of materials and activities within the framework that has been set up by the long-term decisions."

Studies of teacher planning

Researchers studying planning have used a variety of methods, including questionnaires/interviews (e.g., Zahorik 1975; Morine-Dershimer 1978-79a, 1978-79b, 1978-79c) ethnography (e.g., Yinger 1977), simulations (e.g., Morine 1976; Shavelson, Caldwell, & Izu, 1977; Yinger 1977; Borko 1978; Russo 1978), and "think aloud" protocols (e.g.,

Peterson et al. 1978). Not surprisingly, different methods reveal different aspects of the planning process. Nevertheless, the findings of these studies have generally been consistent or complementary. Namely, teachers focus on tasks and related concerns about content, activities, students, goals, and the like.

Most of the research has found that teachers are concerned with subject matter in planning instruction (Shavelson & Stern 1981). Their concern, however, is less with the structure of the subject matter (cf. Schwab 1962; Shavelson 1972, 1974, 1981) and more with the selection of content for the purpose of building tasks (cf. Clark 1978-79; Shavelson & Stern 1981).

Research also has found that teachers consider information about students, especially student ability, when planning instruction (e.g., Cooper, Burger, & Seymour, 1979; Borko 1978; Morine-Dershimer 1978-79b; Russo 1978; Shavelson, Cadwell, & Izu, 1977). Both Morine-Dershimer (1978-79b) and Mintz (1979) pointed out that teachers' concerns about students in their planning were greatest early in the year, when teachers were getting to know their students. Once teachers had reached a judgment about students, less attention (i.e., conscious concern) was given to students in verbal reports. In contrast, Peterson et al. (1978) reported that verbal protocols showed little mention of students during planning. However, these contradictory findings may be an artifact of the methods used. First, in the Peterson et al. (1978) study, students (unknown previously by the teacher) were randomly assigned to teachers. These teachers, then, did not have information about their students. Second, Morine-Dershimer (1978-79b) has pointed out, "while the . . . teachers rarely mentioned pupil ability, specific objective [sic], teaching strategy, or seating arrangement in response to the general question [to state their lesson plans], their ready

responses to the probes indicated that the mental plans or images of the lesson . . . did include such aspects of instruction" (p. 85, italics mine).

A central focus of teachers is the activities developed in a lesson plan (see Table 1). Activity refers to the allocation of time and the sequencing and timing (or pacing) of content and materials during the lesson. While most research has found activities to be of central importance in plans, little is known about how activities are constructed. The construction of activities is probably influenced by those routines (or "scripts") teachers bring to the planning process and which are filled out monthly, weekly, and daily to provide the routine for interactive teaching (cf. Yinger 1977). Yinger's (1977) study provides some insight into activity planning. The teacher he studied approached the activity as a three-stage problem solving task: (1) content, goals, knowledge, and experience combined to yield an initial conception of an activity worthy of future consideration; (2) progressive elaboration of the activity; and (3) activity implementation emphasizing "evaluation and routinization to the teacher's repertoire of knowledge and experience, which in turn play a major role in future planning deliberations" (Clark & Yinger 1979, p. 238). Having established that activities, or tasks, are the focus of planning, researchers need to describe the variety of routines teachers have for planning activities and under what conditions they are used.

Most naturalistic research reports that objectives do not play a major role in planning, whereas laboratory simulation studies report that teachers do take objectives/goals into consideration. These conflicting findings might be resolved on methodological grounds.

Table 1

STUDIES OF TEACHER PLANNING

Study	Method of Investigation	Content Focus: Subject Matter & Materials	Student Focus	Activities Focus	Specifying Goals or Objectives During Planning Unimportant or Secondary	Teachers Have Long-Term Preactive Plans
Borko (1978)	Laboratory	X	X		Contradictory Findings	X
Carnahan (1979)	Literature Review	X	X			
Clark & Elmore (1979)	Classroom					X
Clark, Wildfong & Yinger (1978)	Laboratory	X	X			
Clark & Yinger (1979)	Laboratory		X	X		X
Cooper et al. (1979)	Literature Review	X	X	X		
Joyce (1978-79)	Theoretical			X		X
Mintz (1979)	Laboratory	X	X	X	X	X
Morine (1976)	Classroom/ Laboratory	X	X	X	X	X
Morine-Dershimer (1978-79b)	Classroom/ Laboratory	X	X	X		

Table 1 (continued)

Study	Method of Investigation	Content Focus: Subject Matter & Materials	Student Focus	Activities Focus	Specifying Goals or Objectives During Planning Unimportant or Secondary	Teachers Have Long-Term Preactive Plans
Peterson et al. (1978)	Laboratory	X	X	X	X	
Peterson & Clark (1978)	Laboratory					
Russo (1978)	Laboratory	X	X		Contradictory findings	
Shavelson et al. (1977)	Laboratory	X	X			
Smith & Sendelbach (1979)	Classroom				X	X
Stern & Shavelson (1980)	Classroom	X	X	X	Contradictory findings	X
Taylor (1970)	Classroom	X	X		X	
Yinger (1977)	Ethnography	X		X	X	X
Zahorik (1975)	Laboratory	X		X	X	

Teachers' verbal reports and lesson plans do not emphasize objectives. However, in laboratory simulations where teachers are usually asked to make decisions about goals or objectives, they do so and report that doing so is consistent with their classroom planning (e.g., Borko 1978; Russo 1978). As Morine-Dershimer (1978-79b) pointed out, while objectives are not part of teachers' verbal reports about lesson plans, they are part of the teachers' mental images or plans. Direct or indirect probing, as in simulations or interviews, is apparently needed to find this out.

Finally, several studies have shown that at the beginning of the academic year teachers set forth plans and make decisions that guide subsequent planning over the remainder of the year. This means that, unless researchers examine planning at the beginning of the year, they are liable to miss some aspects of planning. For example, they might conclude that teachers do not consider student characteristics or objectives, though such information is part of teachers' planning during most of the year. Moreover, these long-term plans have a profound influence on classroom teaching. "In effect, the selection of materials and the subsequent activity flow establishes the 'problem frame'--the boundaries within which decision making will be carried on" (Joyce 1978-79, p. 75).

A few findings not reported in table 1 deserve attention. Several studies have found that management of students is a primary concern in planning (Smith & Sendelbach 1979), especially in grouping students (Mintz 1979; Stern & Shavelson 1981). Zahorik (1970) observed that teachers who planned thoroughly were less sensitive to their students

(i.e., encouraged student ideas and discussion less). Peterson and Clark (1978) found that teachers who were prolific planners had students with lower attitude scores than students whose teachers did not plan extensively. These last two studies suggest that planning may be counterproductive if teachers become single-minded and do not adapt their lessons to student needs.

TEACHERS' INTERACTIVE DECISION MAKING

Interactive decision making refers to decisions teachers make while interacting (e.g., lecturing, discussing, tutoring) with their students. These decisions have been characterized as "in-flight" or "real-time" decisions, since teachers typically do not have the luxury of time to reflect or to seek additional information before deciding on a course of action.

Teachers' interactive decisions are greatly influenced by their plans. These instructional plans--perhaps in the form of mental "scripts" (cf. Abelson 1976, Schank & Abelson 1977) or "images" (cf. Morine-Dershimer 1978-79b)--serve as a mental plan for carrying out teaching (cf. Joyce 1978-79; Morine-Dershimer 1978-79b). These images or plans are routinized so that, once begun in the classroom, they are usually carried out Shavelson 1976; Joyce 1978-79; Morine-Dershimer 1978-79b). Routines minimize conscious decision making during interactive teaching (MacKay 1977; MacKay & Marland 1978; Joyce 1978-79; Morine-Dershimer 1978-79b; Clark & Yinger 1979) so the "activity flow" is maintained (Joyce 1978-79). Moreover, from an information-processing perspective, the routinization of behavior makes sense. Routines reduce the amount of information teachers have to consider and the number of

decisions they have to make by rendering the timing and sequencing of activities and students' behavior predictable. Hence, conscious monitoring of instruction can then focus on particular students (MacKay 1977; Connors 1978; Marland 1977; MacKay & Marland 1978; Morine-Dershimer 1978-79b) and on deviations of the lesson from the original plan (e.g., Peterson & Clark 1978; Joyce 1978-79; Clark & Yinger 1979).

Decision making during interactive teaching, then, usually arises when the teaching routine is not going as planned (cf. MacKay 1977; MacKay & Marland 1978; Joyce 1978-79; Clark & Yinger 1979). Usually on the basis of lack of student involvement or behavior problems, teachers judge that the lesson is problematic (e.g., Peterson & Clark 1978), and they may choose to continue the lesson or change it (Snow 1972; Peterson & Clark 1978; Joyce 1978-79). Typically, teachers choose not to change a lesson (Peterson and Clark 1978; Joyce 1978-79; Clark & Yinger 1979). In some cases, this choice is based on a decision to deal with the problem in future plans (cf. (Peterson & Clark 1978; Joyce 1978-79). This tactic seems reasonable because, if teachers continually change lessons, management of students and instructional tasks may become difficult.

Morine-Dershimer (1978-79b, p. 86) has aptly described the nature of decision making during interactive teaching.

> For the lessons examined in detail here, when there was little or no discrepancy between teacher plan and classroom reality, teacher information processing was "image-oriented," with teacher recall of previous knowledge about pupils playing an important part. Decision points were handled by established routines. When there

was a minor discrepancy between teacher plan and classroom reality, teacher information processing was "reality-oriented," with a fairly narrow range of pupil behavior being observed. Decision points were handled by "in-flight" decisions. When a more pervasive discrepancy between teacher plan and classroom reality was perceived, then teacher information processing was "problem-oriented," with teachers tapping a broader spectrum of information about pupils. When a large discrepancy existed, decisions were postponed to a later time.

A model of teachers' interactive decision making

A model of teachers' interactive decision making is presented in figure 2. It is a synthesis of research by Snow (1972), Shavelson (1976), Peterson and Clark (1978), and Joyce (1978-79). The model posits that teachers' interactive teaching may be characterized as carrying out well-established routines. While carrying out routines, the teacher monitors the classroom, seeking cues (e.g., student participation) for determining whether a routine is proceeding as planned. This monitoring is probably automatic as long as student behavior is acceptable. However, if unacceptable behavior occurs (e.g., students are out of their seats during discussion), the teacher has to decide if immediate action is called for and if a routine is available for handling the problem. The teacher may take action based on a routine developed from previous experiences. If no routine is available, the teacher reacts spontaneously and then continues teaching. If immediate action is not called for, the teacher considers whether delayed action is necessary. The teacher notes the delayed action in memory and continues the teaching routine. If no action is necessary,

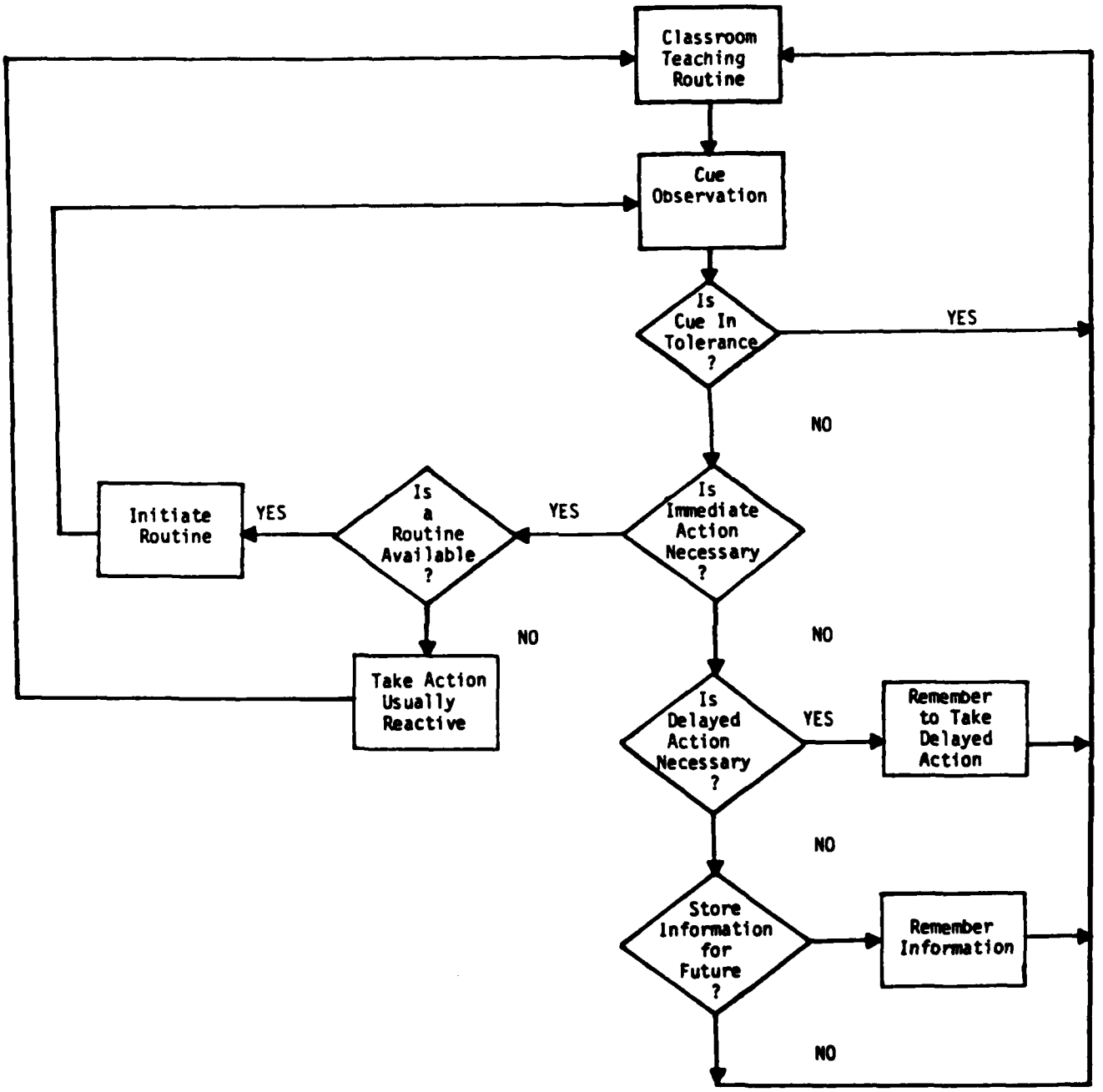

Fig. 2. Model of teachers' decision making during interactive teaching (from Shavelson and Stern, 1981, p. 483).

the teacher decides whether or not to retain the information and continues teaching.

Research on teachers' interactive decisionmaking

Most of the research on teachers' decisions and behavior during interactive teaching has employed the method of stimulated recall. With stimulated recall, the researcher either audio- or videotapes a lesson. After the lesson (or after school, depending on scheduling), the tape is played back to the teacher by the researcher, and the teacher is asked to describe covert mental activities that accompanied the overt behavior.

This research has found that teachers are reluctant to change their routines, even if they are not proceeding as well as expected. When changes do occur, they typically are minor adjustments (Joyce 1978-79). However, this research does not reveal why the teachers are reluctant to change their plans. One possible reason is that, on the basis of experience and the nature of the task, the teacher judged the routine chosen during planning to be better than any alternative routine available. A second possible reason is that the current routine was the only one available and any hastily developed routine might not be expected to fare as well. A third possibility is that changing routines during a lesson introduces uncertainty, both for teachers and students. For teachers, this constitutes an information-processing burden and a decrease in ability to monitor participation and behavior in the class. For students, shifting routines might lead to their having difficulty following instruction, and it might result in learning and classroom management problems (Doyle 1980).

In sum, teachers' main concern during interactive teaching is to maintain the flow of the activity. To interrupt this sequence to reflect on an alternative and consider the possibility of changing a routine drastically increases the information processing demands on the teacher and increases the probability of classroom management problems.

Studies of teachers' reports of their thoughts while teaching reveal that teachers attend to their mental script or image while teaching, and this focus of attention is broken only when monitoring indicates a potential problem or unexpected event. When a problem or unexpected event arises, teachers report becoming "aware of reality" (e.g., McNair 1978-79; McNair & Joyce 1978-79). Their attention then focuses on student behavior.

A very common plan used by teachers during interactive teaching involves structuring, soliciting, responding, and reacting (Bellack, Kliebard, Hyman, & Smith 1966), where teachers ask questions and students respond. Teachers using this plan attend to subject matter and to students. A decision is required when a student gives a somewhat unexpected response. In carrying out this plan, teachers apply certain principles or routines regarding their interaction with students (MacKay 1977; Marland 1977; Connors 1978; MacKay & Marland 1978). One principle is termed "compensation." Teachers attempt to compensate the shy or low-achieving students in their classes, for example, in selecting respondents to their questions. A second principle is strategic leniency, which entails being lenient with a student in need of special attention. A third principle is power sharing, where teachers use the informal power structure to exert their influence. A fourth principle

is progressive checking, where the teacher checks on especially low-ability students' progress during interactions or on assigned tasks. And the fifth principle is suppressing emotions. Teachers systematically suppress their emotions in front of students because their emotions might (a) be a catalyst for unmanageable student behavior; (b) harm students' self-concepts, especially negative reactions toward students' responses; or (c) lead to unjust treatment of different students.

Most studies report that teachers' decision making is not pervasive during interactive teaching (e.g., MacKay 1977; Marland 1977). However, MacKay reported that teachers made about 10 interactive decisions per hour, and Morine-Dershimer and Vallance (1975) reported between 9.6 and 13.9 decisions per lesson! Clearly, teachers make decisions during interactive teaching. In making decisions, teachers tended to consider only a few alternative courses of action. MacKay (1977) reported that teachers seldom considered more than two alternatives, and Morine-Dershimer and Vallance reported means of between 2.2 and 3.2 alternatives per lesson for four different groups of teachers. Moreover, teachers tended not to evaluate alternatives critically; rather, they sought confirmation for their choices (MacKay 1977; MacKay & Marland 1978; see Einhorn & Hogarth [1978] for a review of research on confirmation in judgment and decision making).

Few studies have traced the teaching process from initial information through teacher characteristics and cognitive processes to planning and interactive teaching and the effects of these components of teaching on students' achievements and attitudes. One notable exception is a study by Peterson and Clark (1978). Twelve teachers taught a

social studies unit (not previously taught by the teachers) to three different groups of eight junior high students who they did not know and on whom they had no other information. The study showed that teachers used information about student participation and involvement in the lesson to judge how well their lessons were progressing. They considered alternatives only when teaching was going poorly and changed strategies in about half the problematic situations. However, these changes usually were not major ones; rather, they were more like fine tuning of the original plan (cf. Joyce 1978-79).

Peterson and Clark (1978) also found that teachers high in verbal ability (measured by a vocabulary test) were more likely to generate alternative courses of action and to use a more complex decision strategy than were teachers low in verbal ability. Moreover, teachers high on reasoning ability and conceptual level were very likely to use a more complex decision strategy than teachers who scored low on these measures.

Correlations between measures of planning and interactive teaching replicated Zahorik's (1970) finding that planning exclusively directed to content and objectives may produce rigid instruction. That is, process-oriented teachers were more likely to change plans than content-oriented teachers.

Correlations between a measure of the complexity of teachers' reported interactive decisions and measures of student achievement and attitude were negative! Teachers who considered alternative teaching strategies and even changed strategy during teaching were associated with students lower in achievement and attitude. However, these teachers also experienced problems with their normal teaching routines

and so had to consider alternatives. In contrast, teachers reporting that their teaching went as planned were associated with high student achievement. Routines that maintained the sequence of activities, then, were associated with higher student achievement.

In a review of four studies, (Barr 1974, 1975; Russo 1978; Stern & Shavelson 1981), Shavelson and Borko (1979) examined teachers' policies about grouping students for reading and traced grouping decisions through interactive teaching and student achievement. They reported that most teachers grouped students for reading on the basis of ability. However, a few teachers did not group students, primarily because of a lack of materials and other resources. Once grouped, the group, not the individual student, became the unit for planning instruction. Teachers' plans for low groups differed considerably from their plans for high groups. Procedures, decoding skills (reading aloud), and highly structured assignments were planned and carried out for low groups, whereas flexibility in procedures and assignments and an emphasis on comprehension skills were planned and carried out for high groups. During interactive teaching, the high groups were paced as much as 15 times faster than the low groups, and student achievement in the high groups was correspondingly higher than in the low groups.

IMPLICATIONS

Research on teachers' pedagogical judgments, plans, and decisions has been primarily descriptive. It describes the types of information teachers consider in judging, for example, students' abilities or in making a decision about grouping students for reading. One reason for its descriptive nature is that the recent concept of the decision-making

component of teaching led researchers to ask a new set of questions for which answers were not readily available. Hence, the first step was to describe what decisions, if any, teachers make, how they make them, and what the consequences are for instruction and for students.

Considerable progress has been made over the past 10 years. We now know, for example, the importance of some decisions made by teachers, such as the selection of textbooks and the grouping of students for instruction, what students learn, how much they learn, and how quickly they learn it. However, we are a long way from having an adequate information base; therefore, one proper role of research on teaching is to continue its descriptive work.

However, if this research were to concentrate solely on description, it would be incomplete and of less possible benefit to education than if some of it were directed toward intervening in and improving practice. In order to do so, three types of research are needed. The first is the development of a taxonomy of critical decisions that includes, when available, documentation of the consequences of the decisions. Such a taxonomy would set an agenda for research as well as organize the findings so that they could be archived and made available to practitioners.

The second type of research would attempt to use existing research as a basis for training both pre-service and inservice teachers. One example of this kind of research is that of Vinsonhaler (1979) and his colleagues. Recognizing that reading diagnosticians and reading teachers were unreliable in making diagnoses of individual students' reading problems, they trained diagnosticians and teachers to systematically collect information, integrate that information, and

apply diagnostic strategies in dealing with individual cases. They have met with a modest degree of success. Finally, the third kind of research would combine the first two kinds in developing decision aids for teachers. Again, Vinsonhaler and his colleagues have taken the lead and developed computer-assisted decision aids for reading diagnosticians. It is also possible to identify teachers' policies for grouping students, present these policies to them, and permit them to change their strategies with the aid of computer simulation.

In sum, research on teachers' judgments, plans, and decisions has made an important contribution in expanding our knowledge of teaching. We have asked and are answering a new set of important questions. The current and future challenge for this research is to help improve teaching by using its concepts, methods, and findings to train teachers and to provide decision aids for them.

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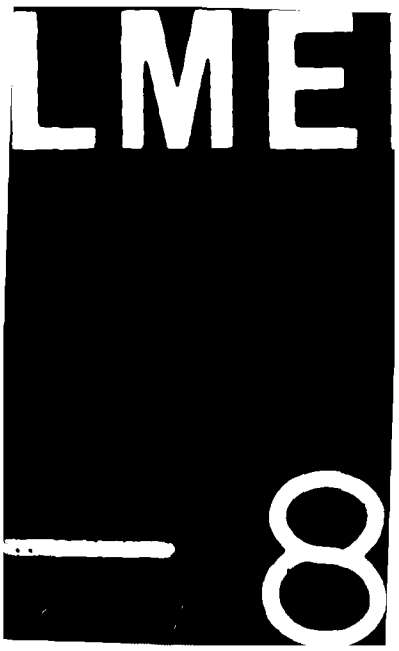
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